E&A

CIRCULAR No. 248 NOVEMBER, 1932
UNITED STATES DEPARTMENT OF AGRICULTURE
WASHINGTON, D. C.

SOD WEBWORMS[1] AND THEIR CONTROL IN LAWNS AND GOLF GREENS

By W. B. NOBLE, *Assistant Entomologist, Division of Cereal and Forage Insects, Bureau of Entomology*

DEPARTMENT OF AGRICULTURE

INTRODUCTION

During the summer of 1931 many well-kept lawns and golf greens were severely injured or destroyed by sod webworms. This unusual and widespread injury aroused much curiosity as to where these worms come from, what they are, and how to destroy them. These insects are present every year, but ordinarily not in sufficient numbers to attract attention. It is thought that their abundance in 1931 was due to their gradual concentration in artificially watered areas of grass during the dry summers of 1930 and 1931 and to the unusually large numbers of the overwintering forms which survived the mild weather of the preceding winters. Another outbreak so extensive may not occur for many years. But since during the summer of 1931 two treatments were found effective for the prompt control of these webworms, it seems desirable to make this information available to the public.

LIFE HISTORY AND HABITS

Sod webworms are the larvae, or young, of certain small, whitish moths, or millers, frequently observed flying about over grass-covered areas, particularly during the early evening. When laying their eggs the moths seek places of luxuriant growth, and the worms are usually more abundant there. During the recent dry summers when succulent growth was scarce, artificially watered areas of grass, such as well-kept lawns and golf greens, offered ideal conditions for the egg-laying activities of these insects; hence their concentration in such places.

There are some 60 to 80 species of webworms in the United States, all quite similar in both the young and adult stages, and all members of the genus Crambus. The moths have a characteristic habit of folding their wings closely about their bodies when at rest, this peculiarity having earned for the entire group the name "close-winged moths."

Practically all the webworms feed on grasses. Only about a dozen species, however, are of economic importance, the remainder either attacking unimportant wild grasses or occurring so rarely as never to become pests.

The eggs resemble tiny cream-colored beads and are dropped at random by the female moths as they fly about over the grass. The

[1] Order Lepidoptera, family Pyralidae, subfamily Crambinae.

143379—32

eggs fall among the grass stems and there hatch in a week or 10 days. The young worms feed on the grass leaves and at once start to form protecting silken webs or nets; within these they remain during their larval life and from them derive the name "webworm." As the worms become larger they construct, close to the surface of the soil, little burrows or tunnels covered with bits of dirt, lined with silk and reinforced with their excrement and with pieces of grass. They then cut off the blades of grass entirely and drag them into the burrows, where they feed in safety and at leisure. One investigator has estimated that during its life each larva eats from 7 to 13 linear feet of bluegrass leaf or its equivalent.

When the larvae have completed their growth and become about three-fourths of an inch in length, they leave their burrows and in the soil near by construct cocoons of silk and bits of earth. These cocoons are about the size and shape of a peanut meat, and in them the worms change to the pupa, or chrysalis, stage. They may do this within a few days or not for several months, depending on the species. The pupa is a narrowly oval, reddish-brown, helpless object which remains quiescent in the cocoon until the adult moth is fully formed. Usually in from 10 days to 2 weeks the moth emerges from the pupa and forces its way from the cocoon to the open air. Within a few minutes the moth's wings are spread and dried, and it is ready to mate and thus beget a new generation.

Webworms pass the winter as partly grown larvae in their little silken tunnels. Mild, open winters permit a much higher survival of such forms than do extremely cold ones. There is therefore likelihood of more webworm injury, as in the outbreak of 1931, following a mild winter.

NATURE OF INJURY

The adult moths live but a few days; and as they take no solid food, it is only in the larval, or worm, stage that these insects are harmful. While the worms are small the injury resulting from their feeding is likely to pass unnoticed. It appears first as small, irregular brown areas in the grass. As the worms grow larger they begin to cut off many blades of grass, and grass growing in the infested turf, where the worms are numerous, takes on a ragged, unhealthy appearance, and large areas of it may be killed. Severe injury may be caused in a few days where the infestation is heavy; hence immediate steps must be taken to effect control.

NATURAL CONTROL

Natural enemies play a rather important part in the control of webworms. Birds were particularly active in this respect during the summer of 1931. Blackbirds, flickers, robins, and starlings were attracted to the infested areas in large numbers and ate many of the larvae. Domestic poultry, when given the opportunity, scratched about in the infested sod and ate many of the webworms.

Parasitic insects also help in keeping webworms under control. The one most frequently observed in 1931 was a small wasplike insect of the family Braconidae and genus Apanteles, which deposits its eggs in the webworms. The tiny parasite maggots issuing from these eggs feed on the internal tissues of their hosts, finally causing their death. Several of these parasites may develop in a single host larva. When full grown, they emerge from the host and spin their

little white ellipsoid cocoons in a mass on the ground. The adult parasites emerge from these cocoons to lay their eggs in other webworms.

Two species of flies—*Phorocera claripennis* Macq. and *Zenillia caesar* Ald.—also parasitized webworms to some extent during 1931. These flies (Diptera) deposit their eggs on the webworms. The maggots hatching from these eggs burrow into the bodies of the host larvae and feed there, eventually causing death.

During the fall of 1931, following a period of plentiful rainfall, many webworms in the vicinity of Lafayette, Ind., were killed by the fungus *Beauveria bassiana* (Bals.) Vuill. This fungus seems to thrive best during periods of high humidity coupled with fairly high temperature, and when such conditions exist it is quite probable that it plays an important part in the control of the sod webworm.

ARTIFICIAL CONTROL

Lawns and golf greens should be watched closely for the appearance of small, irregular brown areas, since these are usually the first indication of the presence of webworms. When such areas are discovered, they should be examined carefully to determine whether the worms are responsible for the injury, for similar areas may arise from other causes, such as the familiar "brown patch" fungous disease. In making this examination it is necessary to separate the tufts of grass and expose the ground surface in order to locate the webs and tunnels in which the worms will usually be found. If the turf is to be saved from serious injury, it must be treated at once with insecticides.

During the summer of 1931 a number of insecticides were tested, two of which gave excellent results. Several of them, however, were found to have little or no value against webworms, probably owing to the location and feeding habits of the worms.

EFFECTIVE INSECTICIDES

Pyrethrum extract in solution and homemade kerosene emulsion gave good control.

PYRETHRUM EXTRACT

Extracts of pyrethrum are sold under trade names. In the writer's tests two of the commercial extracts were used. Both gave good control when properly mixed and applied. The commercial extracts were diluted at the rate of about 1 ounce of the extract to 4 gallons of water and the resulting solution was applied to the infested turf at the rate of about 1 gallon to 1 square yard of surface. In the tests the solutions were applied with an ordinary sprinkling can or watering pot. Within a minute or two after the solution was put on, all the worms came to the surface, where they wriggled about, apparently in great discomfort, until they died. Some of the worms showed signs of life for several hours after treatment but eventually died.

It is imperative that the solution of pyrethrum extract used be made from freshly opened stock and applied at once after being mixed. The chief objection to the use of pyrethrum extract in webworm control is the cost involved where much surface is to be treated. At $17.50 a gallon for pyrethrum extract, the cost of material when the extract is used at the rate of 1 fluid ounce to 4 gallons of water will

be about 3½ cents for each square yard of treated area, or about $9.75 for a plot 50 feet square. However, these extracts are nonpoisonous to human beings and do not injure the grass. If good extract is obtained and properly applied, control is assured.

KEROSENE EMULSION

The well-known insecticide kerosene emulsion gave excellent results. The formula for the stock emulsion was worked out so that it was satisfactory even where hard water had to be used. Kerosene emulsion is cheap, comparatively harmless to handle, and easy to make if the directions given below are followed. Further tests may indicate the necessity for some changes in the formula or treatment, but in the writer's experiments the procedure given here killed practically all the worms without apparent injury to the grass. A stock emulsion is prepared as follows: Dissolve 1 pound of laundry soap in 1 gallon of boiling water; add one-half gallon of kerosene; stir rapidly until a creamy emulsion is obtained with no drops of free oil visible. This stirring may be accomplished by pumping the mixture into itself through a spray pump or by churning it in an inexpensive household butter churn. Small quantities have been prepared with an egg beater. For use in webworm control, 1 part of this stock emulsion should be thoroughly mixed with 50 parts of water and the resulting mixture then applied to the infested turf at the rate of about 1 gallon to each square yard of surface. In the writer's tests it was applied with a sprinkling can. As in the case of the pyrethrum extracts, the worms came to the surface within a minute or two after the material was put on and wriggled about until they died.

The cost of materials for this treatment is about one-sixth of 1 cent for each square yard of treated area, or about 50 cents for a plot 50 feet square. It is thus much cheaper than the pyrethrum extracts, although less convenient to use because of the necessity of preparing the emulsion.

INEFFECTIVE INSECTICIDES

In the writer's tests the treatments listed in Table 1 gave only partial control or no control at all.

TABLE 1.—*Treatments that gave no control or only partial control of sod webworms*

Insecticide	Concentration	Rate of application
Carbon disulphide emulsion	0.05 per cent	1 gallon to 1 square yard.
Paris green	1 pound to 50 gallons of water	2 quarts to 1 square yard.
Lead arsenate	2 pounds to 50 gallons of water	Do.
Do	Undiluted, dust	12 ounces to 100 square feet.
Nicotine sulphate, 40 per cent	1 ounce to 3 gallons of water	1 gallon to 1 square yard.
Poisoned-bran mash bait	1 pound of Paris green to 25 pounds of bran.	10 pounds (dry bran) to 1 acre, or one-fourth pound (dry bran) to 1,000 square feet.
Calcium cyanide dust	40 to 50 per cent $Ca(CN)_2$	2 ounces to 1 square yard.
Sodium cyanide	1 ounce to 5 gallons of water	2½ gallons to 1 square yard.

U. S. GOVERNMENT PRINTING OFFICE: 1932

For sale by the Superintendent of Documents, Washington, D. C. - - - - - - Price 5 cents